STATUS OF MINERAL RESOURCE INFORMATION FOR THE IOWA AND POTAWATOMI INDIAN RESERVATIONS, KANSAS AND NEBRASKA

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CONTENTS

SUMMARY AND CONCLUSIONS

Mineral commodities are not produced at present on either the Iowa or the Potawatomi Indian Reservations. Glacial deposits on both reservations have some potential for sand and gravel that could be used locally for road maintenance and construction aggregate. The Iowa Reservation contains loess (fine-grained marl or loam) deposits that make excellent fill material in earth fill dams and other earthen structures. Although limestone-shale formations underlie both reservations, there is little demand for crushed rock or building stone in the area. The persistent coalbeds found over much of eastern Kansas are present on the Iowa Reservation and probably exist on the Potawatomi as well. However, because of the high sulfur content of the coal, the thickness of overburden, and the thinness of the coalbeds, development of coal resources on the reservations appears uneconomic at this time. A potential for petroleum may exist, although drilling on and near the reservations has been unsuccessful except for one small oilfield near the Potawatomi Reservation.

INTRODUCTION

This report was prepared for the Bureau of Indian Affairs (BIA) by the U.S. Geological Survey (USGS) and the Bureau of Mines (USBM) under an agreement to compile and summarize available information on the geology, mineral resources, and the potential for economic development of certain Indian lands. Source material included published and unpublished reports, and personal communications. No fieldwork was done.

Kansas has four Indian Reservations, all in the northeast part of the State. They are the Iowa in the extreme northeast corner, the Sac and Fox that adjoins the Iowa, the Kickapoo about 20 miles southwest of the Iowa, and the Potawatomi approximately 45 miles southwest of the Iowa Reservation. Both the Iowa and the Potawatomi Reservation are covered in this report (Figure 1).

The Iowa Reservation also extends into Nebraska, forming part of Brown and Doniphan counties in Kansas and Richardson County in Nebraska. The reservation is bounded by the Missouri River on the east and northeast, the Nemaha River on the north, and the Sac and Fox Reservation on the west. Approximately 25 percent of the reservation is in Nebraska. The original Iowa Reservation was established by the treaty of 1836, but was reduced in size by the treaties of May 17, 1854, and March 6, 1861 (Dept. of Commerce, 1974). The reservation area initially included 11,770 acres assigned to 143 individuals. Most of this land has been sold (Figure 2), but approximately 786 acres remains tribally owned, and an additional 512 acres is individually allotted (BIA, 1978). Agricultural and other surface leases on tribal land produce an annual rental of about $6,150. in the individually allotted land, agricultural and other surface leases provide an additional annual rental income of $2,935 (BIA, 1978). In most cases, the mineral rights were sold along with the surface rights.

State Highway 7 passes the reservation near its eastern border and roughly parallels the Missouri River. U.S. 73-159 (North-South) Highway is approximately 5 miles west of the reservation. This highway serves Falls City, Nebraska, and

Hiawatha, Kansas, which are about 7 miles north and 9 miles south of the reservation, respectively (Figure 1).

The tribal population totals 290, most of whom reside on the reservation (Table 1).

TABLE 1
Labor Force, Iowa Reservation

	Male	Female	Total
Indian population			
within reservation	95	105	200
adjacent to reservation	41	49	90
Total	136	154	290
Total under 16 years of age	53	60	113
Total over 16 year of age	83	94	177
Employed, earning $5,000/yr or more	20	17	37
Employed, earning less than $5,000/yr	17	16	33

Source: BIA, 1979

Both the Iowa and Potawatomi Reservations are primarily agricultural, and the growing season extends from early May to early October. Rainfall averages 32 inches per year. Temperatures average 54ºF and range from 110ºF to minus 20ºF (Dept. of Commerce, 1974).

The Iowa Reservation has a good county road system, but adequate bus and truck transportation is available only at nearby Horton, Kansas, and the nearest airport is in Topeka, Kansas. The U.S. Public Health Service maintains an Indian clinic in Horton, Kansas.

The Potawatomi Reservation forms a square, 11 miles on a side and encompassing 77,440 acres (Figure 3). Through sales, fee patent transfers, and other acquisitions by non-Indians, the Indian land holdings have been reduced to 1,337.68 acres of tribally owned and 18,696.90 acres of individually allotted land. Of the tribal land, 1,077.00 acres is under agricultural surface lease at an annual rental of $7,401.00. Of the individually allotted land, 16, 969.16 acres is leased at an annual rental of $185,216.67 (BIA, 1978) .

U.S. Highway 75 runs north and south along the eastern reservation boundary, connecting the cities of Holton, 4 miles north, and Topeka, 16 miles south of the reservation. The nearest commercial airline, bus, rail, and trucking companies are in Topeka.

The Potawatomi Reservation came into existence by Act of Congress in 1887, amended in 1891. The General Allotment Act of 1857, amended in 1891, also had an effect on the reservation (Department of Commerce, 1974). The Potawatomi Indian population totals 1,302, including 332 who reside on the reservation (Table 2).

TABLE 2
Labor Force, Potawatomi Reservation

	Male	Female	Total
Indian population			
within reservation	140	192	332
adjacent to reservation	435	535	970
Total	575	727	1302
Total under 16 years of age	266	280	546
Total over 16 years of age	309	447	756
Employed, earning $5,000/yr or more	200	64	264
Employed, earning less than $5,000/yr	18	172	190

Source: BIA, 1979

TOPOGRAPHIC MAP COVERAGE

Both reservations are covered by USGS topographic maps. Most are 7 ½ minute quadrangle at a scale of 1:24,000 (1 inch equals 0.4 mile), except for one 15-minute quadrangle at a scale of 1:62 ,500 (1 inch equals 1 mile). Map titles follow:

Iowa Reservation

Kansas Quadrangles - 7 ½ minute

Highland 1959
Highland NW 1961
Reserve 1960
White Cloud 1959

Missouri-Nebraska Quadrangles

Oregon, Missouri 1959, 7 ½ minute
Craig, Mo.-Nebr. 1950, 15 minute

Potawatomi Reservation

Kansas Quadrangles - 7 ½ minute

Holton 1960, Photo revised 1978
Mayetta 1960, Photo revised 1978
Soldier Creek NE 1960
Soldier Creek NW 1964
Soldier Creek SE 1964
Soldier Creek SW 1964, Photo insp. 1977

PHYSIOGRAPHY

The Iowa Reservation lies within the Dissected Till Plains section of the Central Lowlands Province (Bayne and Schoewe, 1967). The present landscape was shaped during the second of two periods of glaciation that covered the area. The glaciers left a mantle of glacial drift and loess of variable thickness. Elevations within the reservation range from 850 feet above sea level along the Missouri River to 1,130 feet in the area identified

as Partlow Cemetery along the Kansas-Nebraska border. Principal drainages are the Nemaha River and Roys Creek on the northern part of the reservation, and Squaw Creek in the southeast, all draining into the Missouri River. Intermittent streams dissect much of the area, leaving well-rounded remnants of the original topography with gentle slopes and broad valleys. Average relief is in the range of 100 feet between stream valleys and hill tops.

The description of the Iowa Reservation is generally applicable to the Potawatomi Reservation; however, loess deposits are not present on the Potawatomi Reservation. A significant feature on the Potawatomi Reservation is Soldier Creek, which flows nearly straight south and dominates the western part of the reservation. A broad valley with bluffs rising up to 150 feet above Soldier Creek is typical. Little Soldier Creek, near the eastern boundary and roughly parallel to Soldier Creek, is a smaller topographic feature with less relief than Soldier Creek. The two streams merge about 10 miles south of the reservation. Elevations within the reservation range from 975 feet above sea level, where Soldier Creek flows across the southern boundary, to 1,330 feet, about midway along the northern boundary.

SUBSURFACE GEOLOGY

More than half of the Potawatomi Indian Reservation, the western and southern parts, is known to be underlain by granitic to quartz--monzonitic Precambrian intrusive rocks (Bickford and others, 1979). Since few drill holes have reached the basement in the northeastern part of the reservation, the Precambrian rocks beneath this area have not been identified. Because of lack of similar data for the area of the Iowa Reservation, Precambrian rock types there also are unidentified. A series of magnetic anomalies along the eastern margin of Jackson County probably represent Precambrian intrusive rocks of a somewhat different type, one with greater amounts of magnetite than the rocks of the surrounding area (Yarger and others, 1978).

In the area of the Iowa and the Potawatomi Reservations, the Precambrian rocks are overlain by about 3500 to 4000 feet of Paleozoic rocks (Figure 4). The Lamotte Sandstone, Late Cambrian in age, is probably present in the central part of the Forest City synclinal basin. Upper Cambrian-Lower Ordovician Arbuckle Group state overlie the Lamotte, where present, or the Precambrian. Beds of the Simpson Group, Middle Ordovician in age, unconformably overlie the Arbuckle Group rocks, and are conformably overlain by Middle Ordovician Viola Limestone and the Upper Ordovician Maquoketa Shale.

Silurian-Devonian rocks of the "Hunton Group," principally limestones and dolomites, unconformably overlie rocks of Ordovician age. The Chattanooga Shale of Late Devonian and Early Mississippian age unconformably overlies beds of the "Hunton Group." Except for local areas, information about Mississippian rocks in northeast Kansas is sparse.

Rocks of the Cherokee Group of Pennsylvanian age unconformably overlie Mississippian strata. The Cherokee Group, about 650 feet thick, is made up principally of gray shale with some black shale beds. Rocks of the Marmaton and Pleasanton

Groups conformably overlie the Cherokee Group strata.

Overlying the Pleasanton rocks are formations of the Kansas City Group. In this general area these formations and the overlying Lansing Group rocks are composed of alternating limestones and shales with some sandstones. Altogether, beds of these two groups are about 325 feet thick.

The Stanton Limestone of the Lansing Group is overlain by the Douglas Group, which is made up of shale, sandstone, sandy shale, and minor amounts of limestone. Locally, members of the Stranger Formation of the Douglas Group are present. The Lawrence Formation of the Douglas Group is overlain by limestone and shale beds of the Shawnee Group, which appear to be conformable with beds above and below (Merriam, 1963; Bayne and Schoewe, 1967).

SURFACE GEOLOGY

Formations that crop out on the Potawatomi Reservation are Pennsylvanian, Permian, and Quaternary in age (Figure 5). Formations that crop out on the Iowa Reservation (Figure 6) are Pennsylvanian and Quaternary in age (Merriam, 1963, p. 80; Bayne and Schoewe, 1967; Blanchett and others, 1972).

Alternating limestones and shales of 22 separate formations make up the Wabaunsee Group; these are the oldest (Pennsylvanian) rocks exposed on the Potawatomi and the Sac and Fox and Iowa Reservations. The Wabaunsee Group conformably overlies older Pennsylvanian rocks.

On the geologic map that covers the area of the Potawatomi Reservation (Walters, 1953), the Wabaunsee Group formations are differentiated but mapped as one unit. Unconformably above the Wabaunsee Group are the limestones of the Permian Admire Group, and overlying these beds are shales and limestones of the Permian Council Grove Group. Formations of both the Admire Group and the Council Grove Group have been mapped as one unit (Walters, 1953). Overlying the Council Grove Group are Pleistocene glacial deposits. These deposits cover a large part of the eastern part of the Potawatomi Reservation.

In the area of the Iowa, Sac and Fox reservations in Kansas the Upper Pennsylvanian Bern Limestone and Auburn Shale, mapped as one unit, are the oldest rocks exposed (Figure 6). The Emporia Limestone and the Willard Shale overlie the Bern Limestone and Auburn Shale, and in turn are overlain by the Zeandale Limestone and the Pillsbury Shale. Nearly all the Iowa Reservation is covered by a thin layer of Quaternary loess, till, and alluvium. Rocks of the Upper Pennsylvanian Wabuansee Group crop out in sections 21, 26, 27, 28, T. 1 N., R. 17 E., along the Big Nemaha River and in sections 25, 26, 27, and 36, T. 1 N., R. 18 E., along the Missouri River bluffs (Burchett, R. R., 1980, personal communication). Permian rocks crop out immediately west of the Sac and Fox Reservation. Alluvium, loess, and glacial deposits are not shown on available maps of Richardson County, Nebraska and so are omitted from that area of the map.

STRUCTURE

Structurally, the Iowa and Potawatomi reservations are part of the Forest City Basin. Prior to Late

Mississippian-Early Pennsylvanian time, the Forest City Basin was part of the North Kansas Basin. In this area this basin now contains as much as 400 feet of sediments. It is bounded on the west by the Nemaha Anticline-Brownville Syncline, and on the south by the Bourbon Arch (Merriam, 1963, p. 18). The Nemaha Anticline, which trends northeast--southwest, is pre-Desmoinesian (Pennsylvanian) post Mississippian in age. Paleozoic and Permian formations generally are displaced downward on the east of the Humboldt Fault, which borders the Nemaha Anticline-Brownville Syncline on the east. Apparently there are both normal and high-angle reverse faults along the eastern margin of the anticline. Although the Nemaha Anticline is post-Mississippian in age, pre-Late Ordovician faulting apparently occurred along a northeast-southwest line approximately the trace of the Humboldt Fault (Merriam, 1963).

Minor flexing of the area continued during Pennsylvanian and Permian time, and the westward tilting of surface rocks took place principally before Cretaceous time. There was some deformation and uplift later (Merriam, 1963). No faults are shown to occur at the surface on the geologic maps of the Potawatomi or the Sac and Fox and Iowa Reservations (Walters, 1953; Bayne and Schoewe, 1967; Burchett and others, 1972).

MINERAL RESOURCES

Minerals are not produced at present on either the Iowa or Potawatomi Reservations. Mineral resources, listed in alphabetical order, include coal, limestone, loess (on the Iowa Reservation only), and sand and gravel. Oil is produced near the Potawatomi Reservation, but drilling on that reservation has been nonproductive. No exploratory drilling on the Iowa Reservation has been reported.

Coal

Coal was mined for local consumption in Brown, Doniphan, and Jackson counties as early as 1866. Three coalbeds in northeast Kansas meet the 12-inch minimum thickness requirement to be considered reserves by the Kansas Geological Survey; they are the Nodaway, Elmo, and Lorton beds (Schoewe, 1946).

The Nodaway coal crops out over almost the entire north to south width of Kansas from Doniphan County south-southwest to the Kansas-Oklahoma border. The main restraint in developing Nodaway coal is its high sulfur content (6 to 8 percent, Brady and others, 1976). A 12-inch bed of Nodaway coal crops out just beyond the Iowa Reservation's far eastern boundary. A preliminary evaluation by the Kansas Geological Survey shows that there may be 12 inches of indicated and inferred Nodaway coal under 100 feet of overburden; this represents an estimated total of nearly 4 million tons on the Iowa Reservation. The Kansas Geological Survey (Brady and others, 1976) defines indicated and inferred reserves as:

> Indicated - Estimates of indicated reserves are based on outcrops or borings showing coal 12 inches or greater and at a distance from one half to 1.5 miles between data points. For a single data point the radius distance from 0.25 to 0.75 mile from the

data point where the coal is believed to exist was considered in tile indicated category.

Inferred - Estimates included in the inferred category follow the same basic rules as the measured and indicated classes, except the distance between data points ranges from 1.5 to 6 miles. For individual data points the radius from the individual point for the inferred category would be from 0.75 to 3 miles from where the coal is considered to exist.

The Nodaway coal also crops out south of Dubois, Nebraska, about 30 miles west of the Iowa Reservation. At that point, the coal is 14 to 16 inches thick (Condra and Reed, 1959). No reference to Nodaway coal in Jackson County was found. The Nodaway is the deepest of the three beds discussed, and if it underlies Jackson County, it is probably too deep to be considered economic.

The Elmo coal, like the Nodaway, is a persistent bed that can be traced from northeastern Brown County to the Kansas-Oklahoma border. The maximum thickness of Elmo coal noted (Schoewe, 1946) is in Brown County where the bed was mined extensively for local consumption 50 to 70 years ago. Elmo coal has been mined from at least 81 mines in eastern Kansas; 30 of these were in Brown County and three in Jackson County. The Elmo coal, which is commonly 12 to 18 inches thick, has been mined extensively in the Roys Creek area about 2 miles south of the Iowa Reservation and in the Wolf Creek valley near Robinson. The Elmo coal is 12 inches thick at an outcrop on the Iowa Reservation near the Brown Doniphan County line (Brady, 1979). A preliminary evaluation by the Kansas Geological Survey estimated that the Iowa Reservation has 974,000 tons of indicated and inferred Elmo coal.

Brown County is the only area having a sufficient thickness of Lorton coal to be classified as a reserve. The bed commonly is less than 12 inches thick, but it reaches 14 inches in northwestern Brown County. The small reserves and lack of data on quality make potential development of this coal unlikely in the near future (Brady and others, 1976).

Very little coal has been mined in Jackson County. Only three small underground mines southwest of Larkinburg and approximately 9 miles east of the reservation have been operated (Walters, 1953). No record was found of any coal exploration on the Potawatomi Reservation.

High sulfur content, thickness of overburden, and relatively thin beds discourage the development of coal in the northeastern part of Kansas. Production of most of the coal would entail deep mining and, because of the thinness of the coalbeds, the economy would have to change drastically to make such operations profitable. In the immediate future, coal mining in the State will probably be restricted to stripping operations in southeastern Kansas (Hambleton and others, 1962).

Limestone

Limestone-shale beds appear to underlie all of Brown and Jackson Counties, Kansas (Bayne and Schoewe, 1967; Walters, 1953) and Richardson

County, Nebraska (Burchett and others, 1972). On the Iowa Reservation, such beds are best exposed along Noharts Creek near the western boundary. The Palls City Limestone in Brown County was formerly quarried to a minor extent (Risser, 1960). Apparently, this was the only building stone quarry in the county. The limestones of Brown and Richardson Counties are too soft and are not weather resistant enough to compete in the building stone market with existing quarries operating elsewhere in Kansas (Bayne and Schoewe, 1967). A small market may exist, however, for their use as crushed rock in local road maintenance.

The nearest building stone quarries to the Potawatomi Reservation are about 6 miles west of the. reservation in Pottawatomie County. These quarries are in the Funston Limestone, not present on the Potawatomi Reservation. The Cottonwood Limestone, widely used as a building stone, is found in the northwest part of the Potawatomi Reservation. The three major Kansas building stone producers quarry this limestone in Chase County, about 100 miles south of the reservation (Grisafe, 1976).

Limestone quarries producing crushed rock are active in various places in Jackson County. N. R. Hamm Quarry, Inc., operates several quarries about 6 miles south of the Potawatomi Reservation. Quarries have operated near the northwest corner of the reservation and near Mayetta, but the Hamm quarries appear to be the only quarries operating at present.

The limited demand for building stone, which is adequately supplied by existing quarries, provides little incentive to develop additional quarries. A small market exists for crushed rock in local road maintenance. This market would probably not increase significantly unless major highway construction were to be undertaken in the area.

Loess

Loess, a wind blown dust deposited along the edges of a glaciated area, covers most of the Iowa Reservation to a depth of more than 80 feet. The loess is thickest in the northeastern part of Brown County, Kansas and adjacent parts of Richardson County, Nebraska and thins toward the west and southwest. The loess soils create good agricultural land. Because the wind moves small particles only, such soils are free of boulders and pebbles (Tolsted and Swineford, 1977). Geologic maps of the Potawatomi Reservation indicate that there are no loess deposits on the reservation.

Loess, having relatively high cohesion because of cementation by clay or calcareous material at the grain contact, also makes excellent fill material for use in earth fill dams and other earthen structures. The demand for such material, however, seems very limited in this area.

Petroleum and Natural Gas

Production of oil and gas in Eastern Kansas-Southeastern Nebraska has been mainly from Pennsylvanian rocks (Oros, 1979). Brown County has one oilfield about 14 miles west of the Iowa Reservation. During 1978, 3,695 barrels of oil were produced from six wells, bringing the cumulative production since discovery in 1944 to 153,778 barrels (Paul, 1979). The Falls City oil-

field, Richardson County, Nebraska, is about 10 miles west of the Iowa Reservation. Numerous wells have been drilled in the vicinity of the Iowa Reservation (Figure 1), but no record was found of any drilling activity on the reservation. Total depth of wells generally varied from 2,300 feet to 3,200 feet. Depth to Precambrian rocks, in which oil or gas would not be found, ranges from 3,500 feet to 4,300 feet in the general area of the two reservations.

Oil and gas production has not been reported in Doniphan County. In Jackson County, the Leach field produced 4,130 barrels of oil in 1978 from 10 wells. Its cumulative production is 423,546 barrels since discovery in 1963. Leach field is less than 1 mile northwest of the northwest corner of the Potawatomi Reservation. A second field, the Soldier field, 4 miles north of the northwest corner of the Potawatomi Reservation, was discovered in 1964 and abandoned the same year. Two dry holes have been drilled on the reservation to depths of 2,953 feet and 3,168 feet. An oil and gas lease sale for reservation lands was held in December 1978. Some interest was shown in the southern part of the reservation, but no bids were received.

Sand and Gravel

Alluvium deposits consisting of clay, gravel, sand, and silt are found in and adjacent to stream channels on the Iowa Reservation. They are principally along Roys Creek and the Nemaha River. Glacial till--a mixture of clay, gravel, sand, silt, and scattered boulders--is exposed upstream from the Iowa Reservation along Roys Creek, but only small quantities of deeply buried till appear to be present within the reservation (Bayne and Schoewe, 1967). The small quantity and apparent poor quality of the sand and gravel limit its potential usefulness for local road fill or surfacing material.

A USBM statistical tabulation for 1977 indicates that the Jackson County Highway Department produced sand and gravel valued at $28,500 in 1977. No other producers are shown in the tabulation in Jackson or Brown Counties. Alluvium deposits are present along Soldier Creek and Little Soldier Creek on the Potawatomi Reservation. Glacial till is found over other parts of the reservation. However, as on the Iowa Reservation, these deposits probably have only limited use for local road work and would not otherwise be considered of economic value.

Most of the Kansas and Nebraska production of sand and gravel is associated with dredging operations along major streams, mainly the Kansas and Arkansas Rivers. Sand and gravel production from these two water courses accounts for nearly 65 percent of the State's total. Open-pit operations are common in western Kansas counties (Wolfe and others, 1978).

RECOMMENDATIONS FOR FURTHER STUDY

Based on the mineral resource information available, it appears that further study is not warranted at present.

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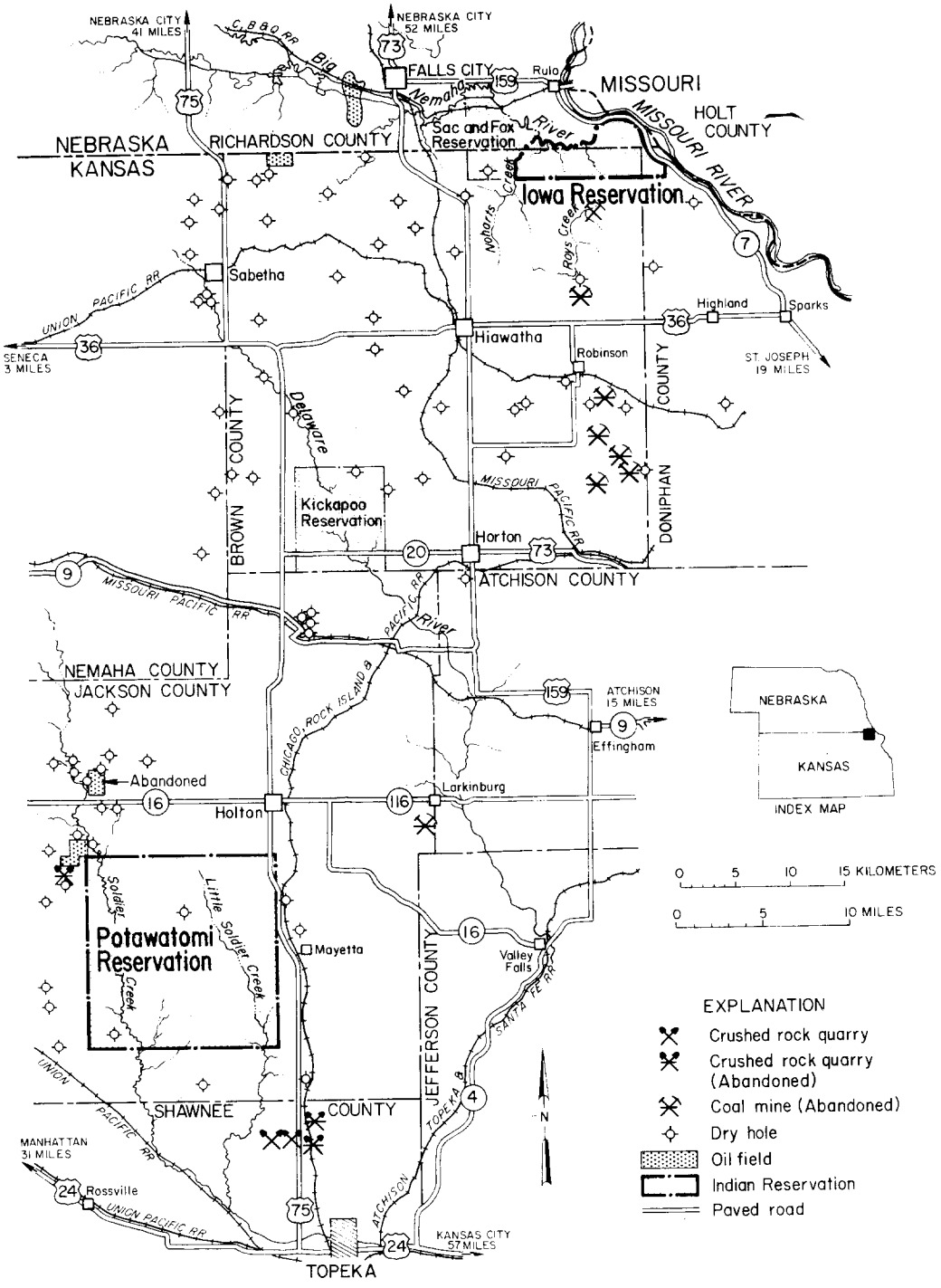

Figure 1. Location and mineral activity map of northeastern Kansas.

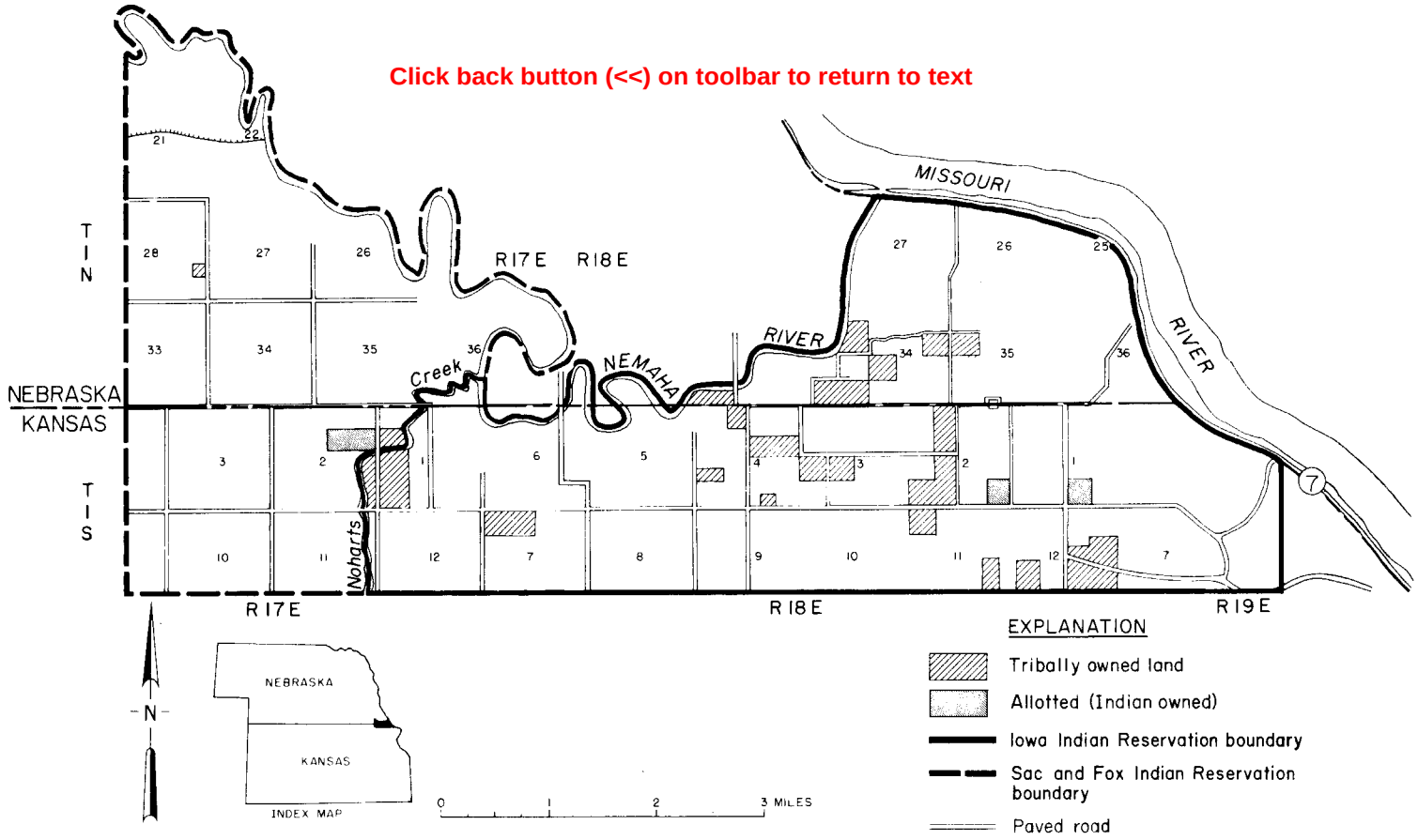

Figure 2. Map showing surface ownership of the Iowa Indian Reservation, Kansas and Nebraska.

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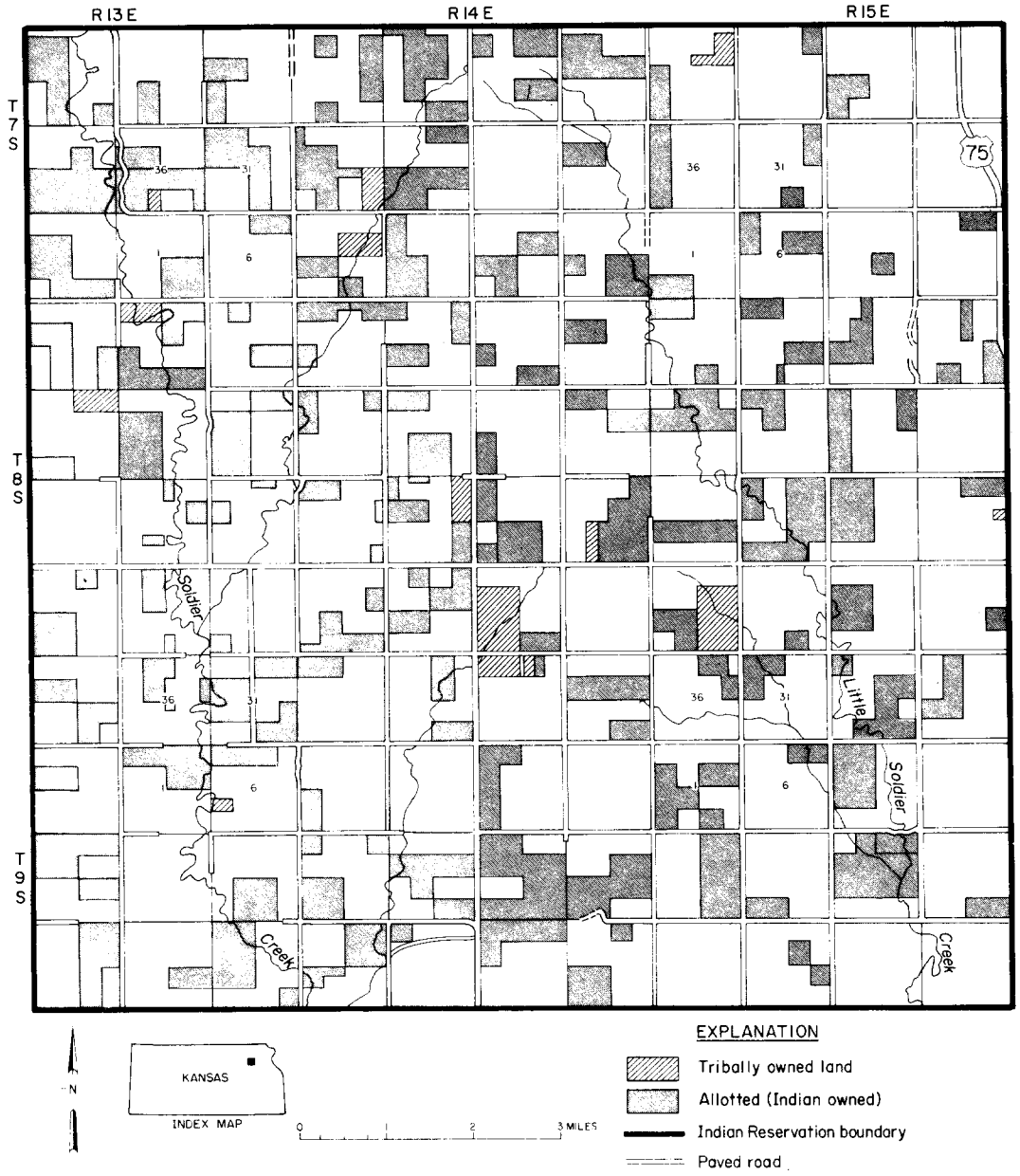

Figure 3. Map showing surface ownership, Potawatomi Indian Reservation, Kansas.

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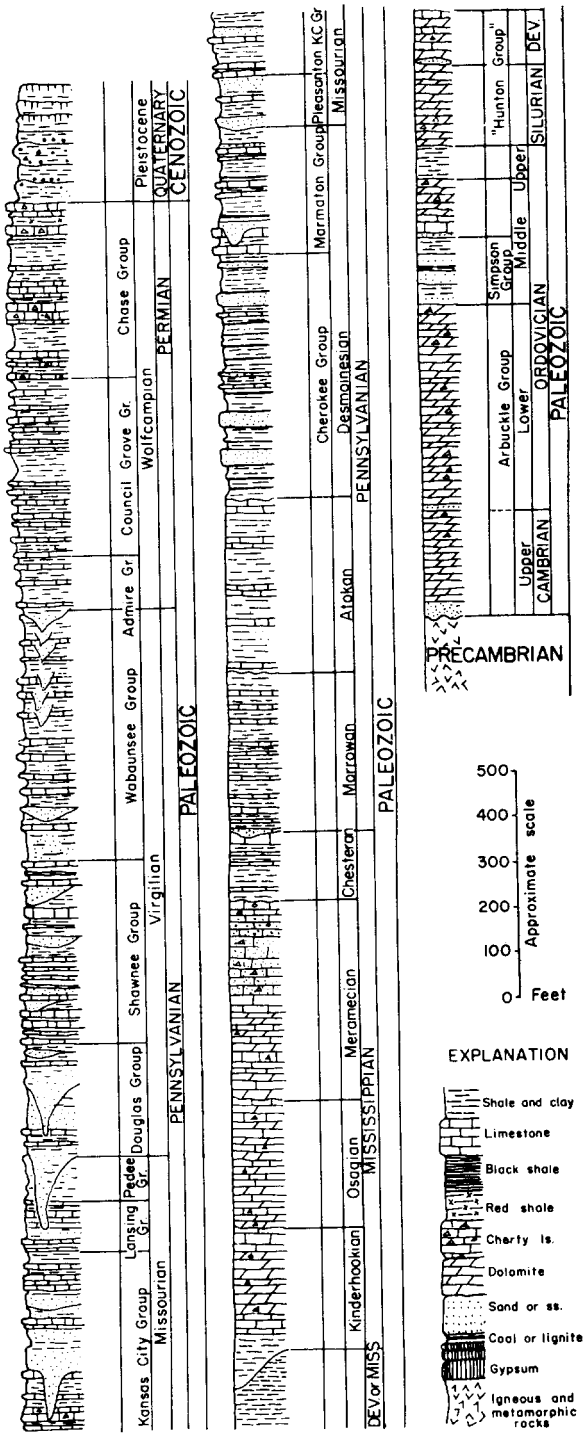

Figure 4. Generalized stratigraphic section of rocks present in northeastern Kansas and southeastern Nebraska (Merriam, 1963; Nebraska Conservation and Division, 1978?).

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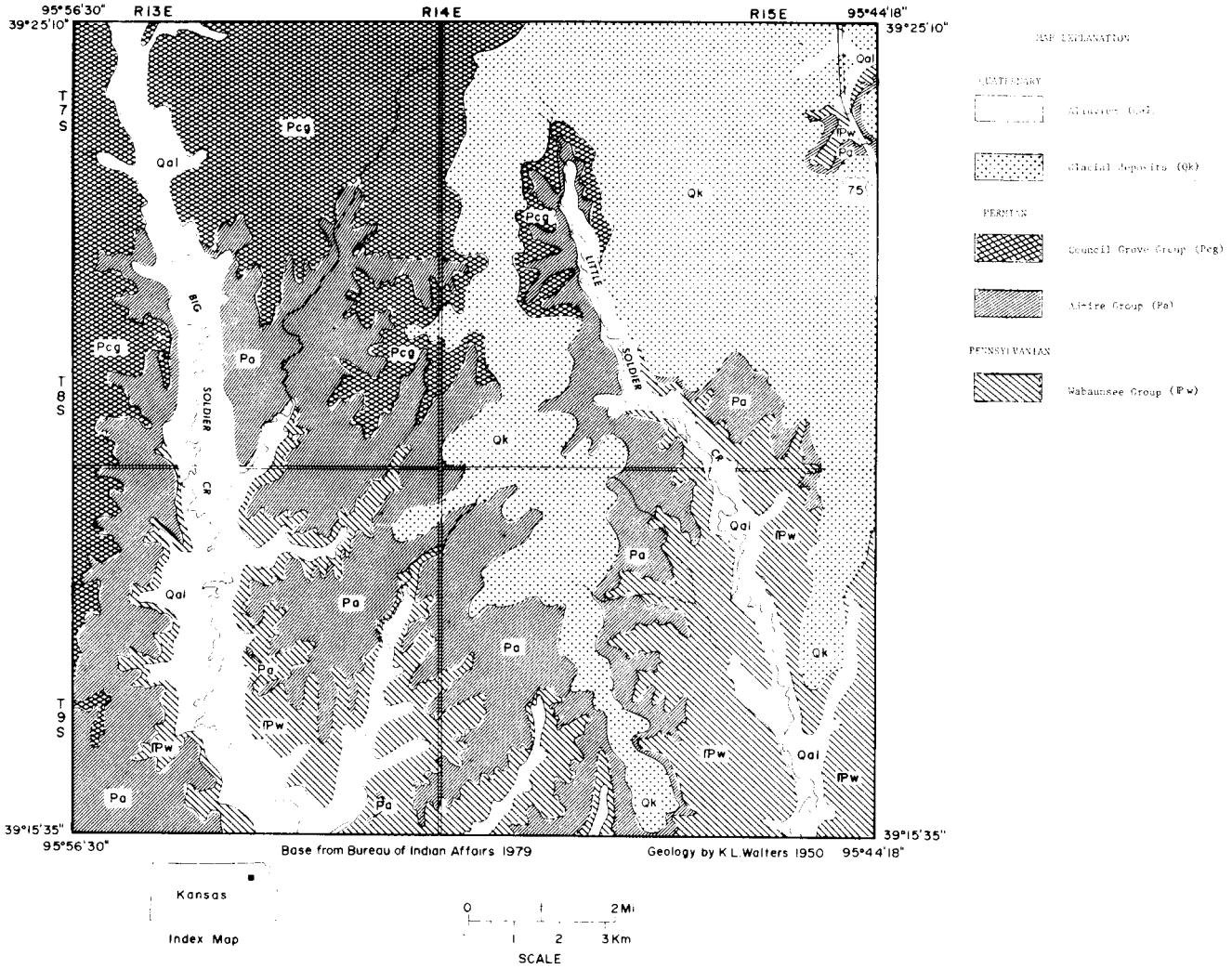

Figure 5. Geologic map of the Potawatomi Indian Reservation.

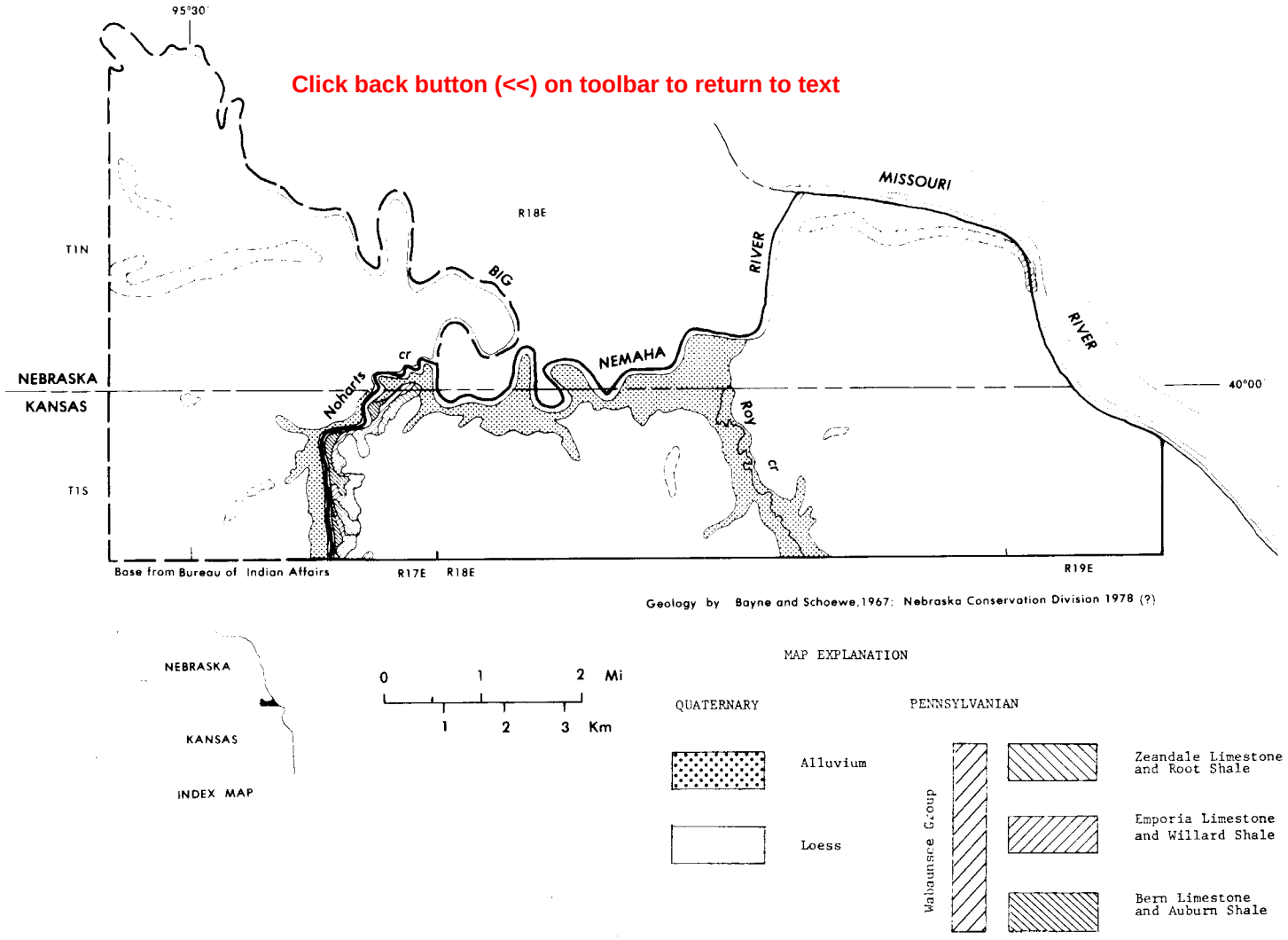

Figure 6. Geologic map of the Iowa Indian Reservation, Nebraska and Kansas.